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UNITED STATES
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HAZARDS OF ENTERING OLD MINE WORKINGS

BY

ALLEN D. LOOK, LEONARD A. VAN FLEET, AND STANLEY M. WALKER

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UNITED STATES DEPARTMENT OF THE INTERIOR - BUREAU OF MINES

HAZARDS OF ENTERING OLD MINE WORKINGS[1/]

By Allen D. Look,[2/] Leonard A. Van Fleet,[3/] and Stanley M. Walker[4/]

INTRODUCTION

The hazards to be encountered in temporarily or permanently abandoned underground mines, quarries, and open pits are numerous, and hardly a year goes by without several reported cases of fatal or serious injuries occurring to unwary people who enter these old mines. Persons visiting mining areas for the first time, tourists, and young people, especially, proceeding in the spirit of adventure common to youth or to the venturesome have suffered many such accidents during exploration trips. The possibility of salvaging salable or usable equipment prompts men and boys to go into old mines, some through ignorance of the attendant hazards, but some jeopardize their lives hopeful of gain (in some cases pitifully small), thinking the hazards are not dangerous and that they can "get away with it."

Persons fall into unprotected holes, some seek shelter from storms under high banks, and quarries and open pits are often chosen as places for recreation, picnics, swimming, etc; all such uses of these places are likely to be hazardous and to lead to accidents, frequently fatal.

These hazards are known to men in the mining profession, and the danger to the public is realized by most of them. A solution to the problem has been sought at many mining meetings, and it is recognized that complete prevention of entry into old mine workings and surface mining areas is the ideal solution, but this, unfortunately, is not always practical; better education of the public, particularly children, should help to reduce the number of such accidents and will be effective in direct proportion to the extent and vividness of such education.

It is the purpose of this paper to describe some of the accidents that have occurred, the means by which they might have been prevented, and the approach to the problem made by the Bureau of Mines, by States, and by many practical mining men.

1/ The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is used: "Reprinted from Bureau of Mines Information Circular 7479."

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ENTRY BY YOUNG PEOPLE

Three teen-age boys were overcome and died as a result of a small fire built in an inclined shaft of an abandoned metal mine in Arizona. The old surface workings and mine openings in the area had long been a playground for parties of young people from neighboring towns. For some reason the boys built a small fire near the bottom of a 45-degree incline 220 feet long and were overcome and killed by the resulting gases while attempting to climb to the surface.

* * * * * *

Two boys, ages 6 and 9, with two older boys were playing in the vicinity of the shaft of an abandoned coal mine in Alabama. The youngest boy went into the crater around the shaft to "look into the hole." On reaching the bottom of the crater, he called for help, and the 9-year old boy went to his assistance and was also overcome. One of the older boys, tying a chain around his waist, went into the crater but found both boys unconscious and was unable to bring them out; he was helped out of the crater by the other boy pulling on the chain. Help was called, but no one was able to enter the crater without being overcome. Firemen using respiratory apparatus finally brought the two boys out after they had lain in the crater for over an hour. All attempts at resuscitation failed; the boys were dead.

The shaft was not covered or enclosed by a fence and no warning signs were posted. A dead oppossum, hawk, and small birds were found in the crater, clear indication of the lethal nature of the gases in the crater.

These two cases are examples of what frequently occurs when owners or operators of mining property fail to fill or enclose abandoned shafts or similar openings or workings near populated areas. Even strongly worded warning signs might have prevented these tragedies. In both cases, after the accidents, the shafts were enclosed or filled, fenced, and warning signs were posted, but it required the sacrifice of five young lives to accomplish what should have been done as a routine job to protect the public.

* * * * * *

Four boys between the ages of 10 and 14 went to an abandoned quarry, where a comparatively deep lake had formed, for the first swim of the summer. Swimming in this quarry pond had been the custom for several years. Two of the boys, who undressed more quickly, dove in but failed to come up. The other two boys waited several minutes, then became frightened, and ran screaming for help. Men arrived who entered the water, found and recovered the bodies; both boys had gashes in their scalps. Artificial respiration failed to revive them.

Investigation showed that the place where the boys usually swam and where this accident occurred had been 10 to 12 feet deep, but a section of bank on the opposite side of the pool and 30 feet away had caved during the winter or spring and large boulders had moved across the downward-sloping

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floor of the quarry and virtually filled the point where the boys had been in the habit of swimming; in diving, both boys struck rocks that were within 4 feet of the surface of the water.

Because of the unknown and possibly changing conditions of the bottom of quarry ponds and lakes, their indiscriminate use for swimming, fishing, and skating should be prevented. Fencing sufficiently substantial to prevent normal entry will serve in most cases; the destruction of such fences, usually by men but occasionally by teen-age boys, might be lessened by better education of the community as to the reasons for erecting the fences. If such places are used for recreation, and in some areas they are the only readily available permanent bodies of water that afford good fishing, swimming, skating, and even small boating, they should be acquired by the municipality, county, or a specially organized group that can determine and plan their safeness and govern their use.

* * * * * *

Two youths, ages 16 and 18, were killed and a third, age 16, was injured by a fall of earth in a clay pit in Arizona. A fourth boy, age 13, was in the party but was far enough away to escape injury. The accident occurred on a Sunday when the pit was not operating. One of the youths tried to climb a hazardous vertical bank and started a run of earth that buried three of the party, crushing out their lives.

Very few clay pits except some of those of the larger pottery companies having valuable equipment in the pit, are protected against trespass during shut-down periods. Many are small operations with a scant margin of profit and without pilferable equipment, and the employment of watchmen or adequate fencing is not economically feasible. Many pits are without any warning signs to advise the public of the dangers of trespass, and such signs are readily placed at any operation, however small, and should be required by State law, and additional protection to the public should be given by those companies financially able to give it.

* * * * * *

Several boys were passing an abandoned air shaft of a coal mine in Kentucky and one of them, age 16, decided to walk down the stairway in the shaft. When he reached the 12th landing he collapsed, and when his companions received no answer from him they went for help.

Two fire trucks with full equipment, including All Service gas masks, members of the police department, and State police immediately responded and went to the scene of the accident.

Several attempts at rescue were made by firemen and police officers, some wearing All Service gas masks, and resulted only in the men themselves being overcome and needing rescue. The attempts at rescue failed to even penetrate to the point where the boy was supposed to be.

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After considerable time had been wasted by these futile attempts, the superintendent of a coal company suggested spraying water down the shaft to carry fresh air into the irrespirable atmosphere. This was successful in replenishing the oxygen in the air and revived the boy, so that he was able to climb out of the shaft unaided.

Thus, a practical knowledge of the efficacy of a water spray in moving oxygen-deficient air and supplanting it with normal air averted what might well have been a fatality and further demonstrates a more or less customary improper use of gas masks. The men wearing the masks depended upon them to purify air deficient in oxygen, which no gas mask will do. The firemen were trained to use the All Service gas mask in fires and smoky atmospheres where the oxygen supply is normal or only slightly deficient, but were not trained in the limitations of the masks. And again, this near tragedy would not have happened if the mine operator had fenced off or sealed the abandoned air shaft.

ENTRY BY TOURISTS AND SIGHTSEERS

Three tourists, two men and a woman, totally unfamiliar with mines and their hazards, were driving through the mountains near a mining camp in Colorado. Stopping for lunch near a mine tunnel, they decided to enter and see what a mine looked like. They carried a flashlight.

They walked about 500 feet in the tunnel to a crosscut that led to an old, heavily timbered, caved-stope area full of rotting timbers. One of the men climbed up a ladder to see "what the top of a mine looked like." When about 50 feet up he was overcome by black damp, lost consciousness, and fell to the bottom, breaking both legs. His companions tried to help him, not realizing that his legs were broken, but they also began to "feel sick" and started to run out. The other man dropped unconscious after running about 75 feet, but the woman managed to get to the tunnel and into fresh air and eventually to the surface.

Stopping a passing car, help was obtained from a nearby mine.

The movements of the "explorers" had apparently stirred up the bad air and freshened it sufficiently to permit a crew to go in, "fanning" the air with their coats, and rescued both men; and artificial respiration revived them in about half an hour.

This was a narrow escape, and had the woman also been overcome in the bad air of the crosscut all three might have perished, as their presence in the mine was unknown, and an empty car on the highway in the mountains is no novelty.

There are thousands of such open, unfenced, tunnels, adits, and shafts without warning signs of any kind in the older camps and mining areas of the nation into which the unwary may wander out of curiosity.

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A group of students at a mining college were having a "keg" party in an abandoned clay pit with vertical walls 50 to 60 feet high. A large bonfire was lighted against the toe of one of the walls, as the temperature was below freezing. It is assumed that the heat from this fire thawed the material at the bottom of the wall and permitted a large section of the bank above to cave suddenly. At the moment, the boys were not directly under the fall and no fatalities resulted, but flying and rolling rock injured five of them sufficiently to necessitate their hospitalization.

Old quarry and open-pit banks or faces are never to be trusted, especially if they have not been worked for several years and have gone unscaled and uninspected for possible loose material. They become particularly hazardous during periods of alternate freezing and thawing - warm days and cold nights - which tend to widen seams and cracks in the rock, increase disintegration, and weaken the banks to the point of failure.

* * * * * *

The assistance of Bureau of Mines engineers was requested to recover the bodies of three soldiers who had been overcome in an abandoned metal mine in Arizona. An officer and three men entered the mine seeking a storage place for explosives. The mine is entered through a 30-degree slope several hundred feet in length. When the men did not return to camp a rescue party was sent to the mine. Three officers entered the mine and managed to bring out one body found a short distance down the slope before they became exhausted and had to give up; the man was dead when brought to the surface. Four men from a water-supply project nearby responded to a call for assistance equipped with paint spray masks and entered the mine but were nearly overcome and barely made their way back to the surface. Several other attempts to enter the mine were made, and all ended with the would-be rescuers becoming ill. Almost a full day after the men were missed, the Bureau of Mines was called, and a crew equipped with oxygen breathing apparatus went to the mine and quickly recovered the three remaining bodies, which were found 300 feet down the slope. A sample of air taken at that point showed carbon monoxide to be present.

The men apparently died of carbon monoxide poisoning; the gas probably resulted from a small underground fire, which had burned itself out before the men entered the mine.

The abortive attempts at rescue made in ignorance of the lethal nature of the gas present might easily have caused the death of men in the rescue parties and definitely delayed an organized rescue by a trained crew properly equipped. If such a crew had been called immediately, some of these men might have been saved.

Old abandoned mines frequently become "death traps," and by such cases as this more weight is given to the argument for closing or sealing all abandoned mines.

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ENTRY FOR SALVAGE

Two brothers, with approximately 6 years' experience as miners, entered a small abandoned coal mine to find and remove some copper wire. Evidently mindful of a gas explosion that caused the death of two men who had entered the same mine for the same purpose about 2 years earlier, the latest victims carried a flashlight instead of an open light, but no flame safety lamp with which to test for impure air.

The next day, the absence of the two men caused the wife of one of them and a brother to make a search for them. These two entered the mine drift but fortunately turned back upon encountering a pool of water about 30 inches deep and 100 feet long. Authorities were notified, and rescue crews wearing apparatus quickly recovered the bodies.

The mine atmosphere contained such a high percentage of methane that the oxygen content was reduced below the point where it would sustain life. A sample of the mine atmosphere analyzed about 9 percent oxygen.

This unfenced, unsealed mine, thus caused the death of four people, and had the searchers not turned back because of the pool of water two more probably would have become victims. The mine was marked with a danger sign, but it was ignored because of the possible profit from the copper wire.

* * * * * *

Three men were killed from asphyxiation in an abandoned coal mine in New Mexico when a thief was taken to the mine to show where he had hidden some stolen goods. A sheriff and another man went to the mine with the thief and smoke was found issuing from the portal; the thief was given a flashlight and entered the mine but failed to return. There followed a series of attempted rescues by the sheriff, a former fire chief, miners, and members of the fire department. All Service gas masks and smoke masks were used by rescuers with fatal results, and when finally oxygen breathing apparatus crews were called the bodies were quickly recovered but two more men from the rescue groups had sacrificed their lives in attempting to rescue the thief.

A New Mexico mining law requires that all openings of abandoned mines be fenced off or blocked. This was not done in this case.

* * * * * *

Three men descended the 46-foot-deep shaft of an abandoned bootleg-coal mine in Pennsylvania to salvage some sheet iron; one survived and two died. When the first man was about 30 feet down he called to the men above him to get out, "the place is full of black damp;" but it was too late; as he yelled, he collapsed and fell to the bottom. The man above started down to rescue him and also fell; the third man, who only went down a few feet, returned to the surface and summoned aid. A fan was rigged up and purified the air, and a trained rescue crew recovered the bodies.

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In this case, a request for assistance from a nearby coal mine was refused by the manager on the grounds that in the past they had several times sent aid to miners trapped by black damp or carbon monoxide in bootleg coal mines and in so doing had suffered fatalities to their own men, and in consequence their company had adopted a policy of refusing aid. Such a policy seems harsh, and it would not have been adopted if such cases were rare, but the frequency of such calls for help and the tendency of brave men to take extreme chances to aid a fellow man in distress has caused a number of companies to refuse to place their own men in jeopardy to rescue men who enter abandoned or bootleg mines against all rules of safety and common sense. The adoption of such policy, however, assumes that all persons in a mining community are thoroughly familiar with the hazards of abandoned mines, which is not true; nor will it be until the community as a whole is better educated as to these hazards.

ENTRY FOR INSPECTION

Five men were overcome by black damp, four of them fatally, when they were lowered in a cage to the bottom of the shaft in an old coal mine that had been shut down for some time. The president, superintendent, and three employees of a company entered the mine to inspect it with a view to leasing it.

Preliminary to entering the mine, the fan was started, but there was difficulty in keeping it running; the air shaft appeared to be caved, but it was thought that there was a hole through the cave large enough to permit air to enter. One man suggested that he descend to determine whether the air was allright, but the superintendent thought the air at the bottom would be good. There was no bell cord or means of signaling the hoisting engineer operating the cage.

The five men were lowered down the shaft. Halfway down, one man (the survivor) complained of feeling "choked up"; he remained on the cage while the other four men got off. Just before he lost consciousness he heard the superintendent call to the engineer to raise the cage, but the engineer was shoveling coal on the fire at that moment. When the engineer returned to the shaft and looked down he saw a light and one man. He called several times and, receiving no answer, assumed that something was wrong and raised the cage with the unconscious president of the company on it with a badly injured leg, which had hung over the edge of the cage and had been caught between the edge and the timbers. Help was summoned, but, because of breakdowns to the hoisting machinery and inadequacy of rescue equipment, although several attempts were made, no bodies were reached until a Bureau of Mines rescue crew with self-contained oxygen breathing apparatus was finally called and recovered the bodies 1 hour after reaching the mine but nearly 12 hours after the accident occurred.

This is the old story of entering a mine that has been shut down or abandoned without first ascertaining the condition of the air. Some of these men evidently realized the hazard but "took a chance," and in consequence lost their lives. The tragedy might have been averted if a signal or bell line had been lowered in the shaft, so that the engineer could have been signalled immediately upon realization of the presence of bad air.

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A young mining engineer, having heard of a likely prospect on the Mojave desert in California, hired a helper and drove to the mine to inspect it. There was a vertical square-set shaft 100 feet deep, which bottomed on a drift allegedly driven on an ore body. A ladder was nailed to the timbers in the shaft.

Using a flashlight for illumination and a candle to determine the condition of the air, the engineer descended the ladder, followed by his helper. When about 30 feet down the helper started to climb out, yelling to the engineer to stay where he was. When the helper reached the surface he called down and informed the engineer that just above his head, on a timber back of the ladder, was a large rattlesnake, coiled and ready to strike.

In semi-dormancy the snake had not been sufficiently aroused to strike as the engineer passed it on the way down, and he failed to "spot" it with his flashlight although only a few inches away, but it was now rattling and ready to strike, which precluded any attempt to climb past it. A descent to the bottom of the shaft disclosed a dozen or more snakes in hibernation there and dropping pebbles had aroused them into a squirming mass.

One alternative remained; the engineer chose a spot a few feet below the snake, where ricocheting bullets from the opposite wall would be least likely to strike, and swinging out from the ladder as far as possible, a leather jacket protecting his head from the falling snake, he ordered the helper to use his 45 Colt and shoot the snake off the timber. Two shots accomplished this and no casualties resulted beyond a puncture wound on the cheek from a flying splinter.

Poisonous snakes and scorpions are a frequent hazard in abandoned mines, especially in desert countries, and their presence should be carefully watched for. In timbered mines, snakes are not always easily detected, as they sometimes lie along timbers and lagging overhead. In snake-infested countries snakebite kits should always be carried.

PREVENTIVE ACTION BY STATE GOVERNMENTS

Many States have laws of varying adequacy and clarity requiring the closing of abandoned or shut-down mines as a protection to the public. Some of these laws are so loosely drawn that they afford little, if any, protection; one State requires that any operator shutting down a mine shall erect a fence around all open holes, but does not require that these fences shall be maintained in good repair, and they are quickly knocked down by cattle and vandals and remain down; but the law has been complied with if the fence is constructed, even though it may be a flimsy affair.

Many laws fix the responsibility upon the operator of a mine, but an abandoned mine has no operator; few laws fix a definite responsibility upon the owner. In one Western State a bill to require the owners of all inoperative or abandoned mines to completely close them against entry was defeated in the legislature when it was discovered that ownership of nearly all of the abandoned mines was vested in the counties, through delinquent taxes, or in the Federal government, through abandonment of unpatented lode claims.

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Proof that the existing laws are entirely ineffective lies in the great number of open, unfenced mine workings without a warning sign of any kind in virtually every State in the Union.

The Industrial Code Rule No. 31 of Department of Labor, State of New York, is as follows:

Section 31-11 Protection of Openings:

31-11.1 Disused shafts. All openings into shafts not being used for the passage of men or materials shall be securely and permanently closed to the passage of persons by means of a fence or a tight covering.

31-11.2 Surface openings. The sides of all openings on the surface where the drop into the opening exceeds 6 feet shall be securely protected by a fence.

31-11.3 Abandoned excavations. All abandoned excavations shall be securely fenced or completely closed to the passage of persons.

31-11.4 Sumps. All sumps shall be securely fenced off or covered.

These four sections of the Code cover the protection to the public that is needed, but the responsibility is not fixed, and by implication it can be interpreted to apply to an operating company exclusively.

Trespassers and vandals are known to have kindled many fires in coal mines, and several of these have become disastrous. Many fires are burning in abandoned coal mines today that might be extinguished or might have been prevented by proper sealing. Some of these fires threaten nearby dwellings, farms, and even communities, and sealing these mines would not only offer protection to the public but possibly would preserve coal that might eventually be mined, as well as prevent residential and business properties from being damaged or causing their abandonment.

Streams are being polluted by the drainage from old mines, both metal and coal, and sealing would tend to prevent this hazard to health; this is a serious problem and alone justifies the requirement that abandoned mine openings be sealed.

Existing laws are inadequate to enforce guarding and sealing of open mine workings. Even when responsibility is fixed or assumed by the County, State, or Federal Government, funds are lacking to undertake sealing of all abandoned mines, as large expenditures would be required in many of the areas where this work is most needed. Even if sealed, more or less continuous work would be required to maintain the seals.

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More comprehensive laws are necessary, responsibility should be definitely fixed, and funds should be made available for properly guarding the public against these hazards, which take a toll of life as well as property of persons not responsible for the condition nearly every year in virtually every mining section of the nation.

PREVENTIVE ACTION BY MINE OPERATORS

Because of the indicated need for action to prevent accidents resulting from entry into old mines, the Arizona Small Mine Operators Association decided to assist in the education of young people in a knowledge of the hazards involved by publication of a safety message. In cooperation with the Health and Safety Division of the Bureau of Mines, John Powers, of the Safety Department of the Anaconda Copper Mining Co., and Dr. H. L. Stahnke, of the Arizona State College, suitable text material was collected and drawings were prepared for publication in the form of a folder written for young people in the sixth grade and beyond. Text material is also included in the drawings, so that the information will be read if the child does no more than follow the cartoons as a child would read a comic strip.

The folder is reproduced herein to obtain as wide dissemination of it as possible.

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NO! DON'T GO EXPLORING THAT OLD MINE, BOYS. IT'S TOO DANGEROUS!
DISSAPOINTED, EH? WELL, LET'S SEE. WHAT IF I TAKE YOU IN THERE AND SHOW YOU WHY IT IS
OH, BOY! HE EVEN LENT US REAL MINER'S HATS
WE'LL GO IN THE TUNNEL ENTRANCE. IT'S SAFER

Young Man—Beware!!

Do you ever have the urge to go exploring? Most boys do—and so do adults! Some people go in pursuit of harmless adventure—others in pursuit of dangerous ones. Right here in our own state we have both kinds of adventurers. Those who seek dangerous pastimes often meet with sorrow and misfortune.

Many young folks, as well as adults, have suffered injury and death while attempting to satisfy a desire to explore old mines, caves, and open pits. Our western states are full of these dangerous places, many of which date back to the early days of prospecting.

There is little to be seen underground that cannot be seen on the surface with greater comfort and safety. Even the innocent-looking area around an old mine may be a death trap for someone. The person who purposely enters such a place not only may be violating the law as a trespasser, but he is also taking his life in his hands!

Recently, three boys in quest of adventure went down the shaft of an old mine near Peoria, Arizona. When they did not return home at the expected hour, a searching party was organized to hunt for them. Their lifeless bodies were found in the shaft—only a few feet from safety! They had built a fire, probably to smoke out some bats, and the fire consumed the oxygen—or they may have died from the poisonous gases given off by the flames. The exact cause may never be known, but no list of causes can ever recall their lost lives.

In the hope that further tragedies may be prevented, the Arizona Small Mine Operators Association, in cooperation with the United States Bureau of Mines, presents the following information concerning the dangers of entering abandoned mines, caves, and open pits.

Common dangers found in exploring these openings are:

1. Rotten timber (posts and timbers supporting roofs and walls).
2. Broken or rotten ladders, steps, stairways, or any other means for getting in and out.
3. Unsupported roofs and walls (danger of falling rocks).
4. Bad air (lack of oxygen or the presence of deadly gases).
5. Underground holes and shafts (covered or uncovered).
6. Water (unfit for drinking or the danger of drowning).
7. Underground fires (burning up oxygen or giving off poisonous gases).
8. Abandoned explosives (dynamite, powder, and detonators).
9. Snakes, spiders, scorpions, and poisonous insects.
10. Danger of becoming lost.
11. Caving ground (ledges, rims, and mine surfaces).

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ROTTEN TIMBER

All wood will rot. Mine timbers are used to support the roof and walls. When they rot or become weakened great danger exists from rock falling. Underground timber may rot faster than surface timber. This is because moisture and humid air are often found under the surface. Even though mines are working, the experienced miner must be careful to replace and repair faulty timber. It may mean his life. In an abandoned mine the danger created by rotten timber is increased a hundredfold. To the casual observer this rotten timber may appear to be in good condition. Yet, only a touch or slight jar may cause the timber to crumble and let the rock fall. A large boulder falling a few inches can crush out a life!

YOU SEE, BOYS? HERE'S A BROKEN SHAFT LADDER, JUST HANGING BY A RUSTY NAIL AND A WHISPER! NOW, SUPPOSE I HADN'T MET YOU AND YOU CLIMBED DOWN THIS SHAFT?

BROKEN OR ROTTEN LADDERS, ETC.

Entrance to or exit from underground workings is often by ladders. These are usually built of lightweight material that rots quickly. Steps and stairways in surface buildings deteriorate with age. There is no safe way by which the trespasser can determine their condition. For your life's sake—stay off them!

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MINERS USE A PINCH BAR TO TAKE DOWN LOOSE ROCKS BEFORE THEY FALL. WE'LL HAVE TO USE THIS OLD PIPE, THE BEST WE CAN, RIGHT NOW
HE SURE IS CAREFUL, I'LL SAY!

UNSUPPORTED ROOFS AND WALLS

Many underground passageways, tunnels, drifts, stopes, and other working places do not need timber support during the mining operations. When the mine has been deserted, these conditions change with time. The weight of the earth overhead in constantly pressing down and squeezing in. Finally, the roof falls. There is no sure way of knowing when that moment is at hand. The erosion by underground water and the action of air help to loosen hanging rock and cause it to fall.

BAD AIR

The normal atmosphere we breathe is composed of several gases. Oxygen, an important part of normal atmosphere, is the only gas that will support life. Without it we would die. Mine atmosphere, or mine air, may be contaminated with gases that are poisonous or that may crowd out the necessary oxygen.

Minerals and decaying timbers use up oxygen. Carbon dioxide is given off by decaying timbers. Some gases are released from rocks and decaying vegetable matter. In active mines it is necessary to keep fresh air coming in from the outside to ventilate the places where men are working. When mines are deserted, air no longer may be circulating or air passages may be completely blocked by fallen rock or timber. In many abandoned mines no fresh air is present below the surface. Persons have lost their lives even in shallow pits, wells, and cisterns because of bad air!

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EASY, LADDIE! STAY BEHIND ME ON SOLID GROUND. THAT ROTTEN CHUTE COVERING MAY GIVE WAY AND DROP YOU A HUNDRED FEET.
LOOK! SOMEONE LEFT A SWELL FISH-BAIT CAN!

UNDERGROUND HOLES AND SHAFTS

Underground holes may be man-made or caused by caving ground. Both shafts and abandoned holes are dangerous, even those of a mine which is working. A person falling into an underground hole may plunge hundreds of feet to his death below. These holes, when covered over, can be more dangerous than when left open because the cover may be rotten or broken.

SEE? WHAT YOU BOYS THOUGHT WAS A SMOOTH CEMENT FOUNDATION IS REALLY A DEEP WATER FILLED WINZE. THE FINE DUST ON THE WATER'S SURFACE FOOLED YOU
MR. JONES IS A SMART MAN. HE EVEN BROUGHT FRESH WATER ON ACCOUNT OF MINE WATER IS USUALLY UNFIT TO DRINK.

WATER

Much mine water is unfit for drinking. It frequently is contaminated with minerals or filth.

Underground lakes, reservoirs, pools, and sumps are very common in abandoned mines. They may be of unknown depth and area. Sometimes the water surface, when covered with fine dust, may even look like solid ground.

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THERE WAS A DISASTROUS FIRE IN THIS MINE ONCE. A MATCH, STILL BURNING AND CARELESSLY TOSSED AWAY, PROBABLY CAUSED IT. WE SHALL GO NO FURTHER IN THIS AREA. DEADLY GAS MAY STILL BE PRESENT AFTER ALL THE YEARS!

UNDERGROUND FIRES

Underground fires present three important dangers: (1) the consumption of oxygen; (2) the release of carbon monoxide, a deadly gas; and (3) the spread of the flame.

Any fire, even though only smoldering, burns up oxygen. When the oxygen, which is necessary to keep the fire burning, is used up, the flame goes out. But the danger point to human life has, by that time, already been reached!

Carbon monoxide comes from burning fuels such as coal, wood, oil, rags, and papers. It mixes very quickly with the air, and a very small amount of it can be dangerous. It has no color, or odor, or taste and a person may not actually know when he is breathing it! The best safeguard is fresh air—stay on the surface where there is fresh air!

HANDS OFF, FIRST! THEN, TELL A GROWN PERSON IF YOU FIND ANY EXPLOSIVES, ANYWHERE! I'LL RETURN LATER AND TAKE PROPER CARE OF THOSE

ABANDONED EXPLOSIVES

Quantities of explosives such as dynamite, black power, and detonators (blasting caps) are frequently left around deserted mines. These explosives deteriorate with age and are very dangerous. A slight jar, excessive heat, or just handling may set them off and blow a person to kingdom come!

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SNAKES, SPIDERS, SCORPIONS, AND POISONOUS INSECTS

Because it is cool in summer and warm in winter, and because they generally offer a good food supply, old mine openings often furnish shelter for snakes, deadly spiders, scorpions, and dangerous insects. In these dark recesses their vicious bites or stings become a constant threat to innocent hands, feet, and limbs of persons who go exploring.

CUTAWAY VIEW OF MAZE OF UNDERGROUND TRAVELWAYS
GOLLY! I HOPE NOTHING DID! EVEN WITH THESE MINER LAMPS WE COULD NEVER FIND OUR WAY OUT
GOSH, JIMMY! WHERE DID MR. JONES GO? MAYBE HE FELL IN A HOLE! WONDER WHAT HAPPENED TO HIM.
I'LL JUST HIDE HERE IN THE DARK AND LET THE EXPLORERS STEW A BIT AND REALIZE HOW IT FEELS TO BE LOST IN A MINE

DANGER OF BECOMING LOST

Many old mines and caves are made up of a network of underground passages. It is not uncommon for a miner to get lost even in a working mine where there are lights, markers, and familiar signs to guide him. How much easier it is for a stranger to get lost in a mine or cave where he does not have the friendly aid of modern devices for finding his way in and out. There are countless stories of persons who have become lost and later are found dead from exhaustion, thirst, hunger, or exposure in old mines and caves throughout the country.

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NOW, WE'RE CLOSE TO WHERE YOU LADS INTENDED TO CLIMB DOWN. THE GROUND ABOUT THAT SHAFT COLLAR IS SO BAD THAT THE WEIGHT OF ONE OF YOU COULD CAVE IT.
DANGER KEEP OUT

WERE WE LUCKY! HAVING MR. JONES GUIDE US THROUGH THAT OLD MINE AND SHOW MANY OF THE DANGERS! AND HE'S THE FOREMAN OF THAT OPERATING MINE!
HE WAS SO KIND, TOO! NOW, HE WANTS US TO DO HIM A FAVOR AND WARN THE OTHER KIDS OF HOW RISKY IT IS TO EXPLORE AROUND OLD MINES.
WE SURE WILL!

CAVING GROUND

The surface around abandoned mine openings, caves, and open pits is subject to caving without warning. Overhanging ledges, or the rims of pits and caverns, may fall with the slightest increase in pressure. The danger is not only to those who walk too close to the edge but also to anyone who happens to be below. A short time ago a young worker lost his life because a rock fell from the rim of a gravel pit. He was working on a ledge beneath the rim of the pit when the falling rock crushed out his life.

Your best bet is to play it safe and not go near these dangerous places.

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AVAILABILITY OF MATERIAL

The folder just described has been published by the Arizona Small Mine Operators Association as a contribution to safety and may be reproduced in whole or part, with or without credit. The folder can be supplied at a price of $3.65 per hundred delivered anywhere in the United States. On orders of 1,000 or more the name of the donor or distributor will be printed in the box on the back page. Inquiries should be sent to Charles F. Willis, State Secretary, Arizona Small Mine Operators Association, 528 Title and Trust Building, Phoenix, Ariz.

The mere distribution of the folder described is not advocated as a substitute for such safety measures as sealing and fencing the openings of abandoned and idle mines and the posting of warning signs and similar devices to prevent and discourage entry. If people could be taught to understand the hazards of exploring abandoned and idle mines and quarries, many of the accidents resulting from such actions would not occur. It is believed the pamphlet will act as a means of education to that end.

PREVENTIVE ACTION BY THE BUREAU OF MINES

The Safety Division of the Bureau of Mines conducts courses in accident prevention in all types of mines, quarries, and open pits for the employees of operating companies. Sections of these courses deal specifically with the hazards of entering abandoned mines and quarries and the necessity for and technique of sealing off fire or other hazardous areas in mines. These hazards are described, and the means by which accidents may be avoided are outlined and impressed upon the groups to whom the courses are given. In addition, the groups receiving the courses are strongly urged to carry the information beyond their own members and into schools, boy and girl scout groups, and various other community organizations. The subject has been made the basis of talks given by Bureau of Mines personnel to luncheon clubs and safety meetings.

The need for further dissemination of this information is the principal reason for publishing this paper.

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